



**Washington State
Department of Transportation**

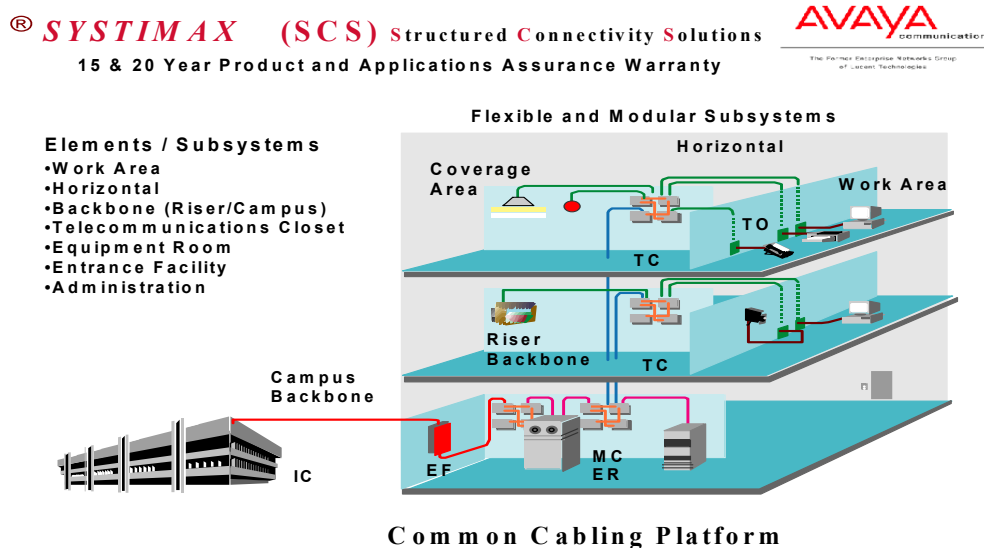
Telecommunication Infrastructure Cable Standards

Olympic Region Office Building
February 2006

INSTALLATION

General Description

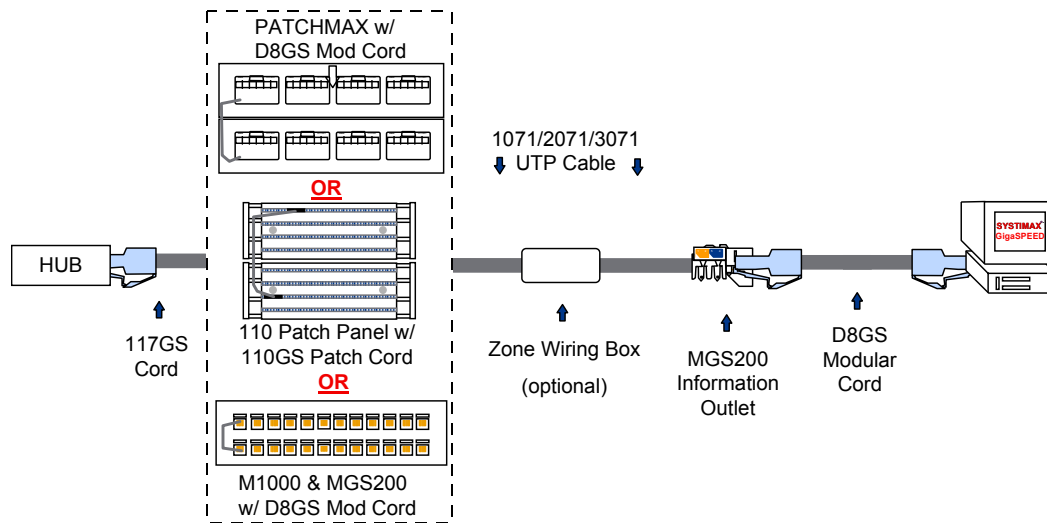
The Structured Cable Solutions (SCS) components of **Washington State Department of Transportation (WSDOT)** will consist of all Systimax® products, be installed by a Systimax certified value added reseller (VAR). SCS is a structured cabling system consisting of copper and/or fiber cabling products deployed according to specific engineering design rules. Installed by Value Added Reseller's (VAR's) providing a Systimax 20 year Extended Product, Labor and Applications Assurance Warranty that will consist of the following:



Subsystems

The Systimax Gigaspeed channel shall be defined as all cable and components with up to four connections (worst case) that comprise the full 100-meter circuit. The Gigaspeed channel shall support all current and emerging high bandwidth applications, including 1000 BaseT Ethernet (Gigabit Ethernet) and potentially 1.2 Gigabit ATM and 2.4 Gigabit ATM as well as 77 channel (550 MHz) of analog broad band video. All components shall be from a single manufacture and warranted for 20 years. The Gigaspeed Channel shall be comprised of the following components as illustrated:

Gigaspeed Channel



The Gigaspeed Channel as illustrated above with four (4) connections shall have Positive Attenuation to Cross talk Ratio (ACR), across the full frequency range of 1MHz – 250 MHz. At no point across the frequency range of 1MHz – 250 MHz shall the ACR drop below a positive ACR.

The Gbps cable and Gbps components shall be electrically compatible with existing Category-3, 4 and 5, plus future networks. The Gbps components shall be engineered and manufactured to compensate for any CAT3, 4 or 5 component cross talk and shall provide at least CAT 3, 4 or 5 performance in all of the customer's existing installed base of voice/data/video.

The Gbps cable and Gbps components shall be physically compatible with existing installed base of equipment. The Gbps cable and Gbps components shall not require special cords, specialty tools or special installation requirements.

Horizontal Subsystem

The Horizontal Subsystem provides connections from the horizontal cross connect (IDF / MDF) to the information outlets (IO's) (workstations) in the work areas. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and IO's in the work area. Each floor of a building is served by its own Horizontal Subsystem.

Horizontal Cabling

The cabling contractor shall cross-connect the Voice workstation jacks at each IDF to the vertical riser distribution cables to the common MDF equipment such as PABX or host computer in the equipment room can terminate.

In other words, each voice jack from each floor will be given a jack number. This number will have a continuous continuity (cross-connected) through each IDF to the MDF, and they will be labeled the same in numerical order on the MDF (Voice cabling only)

Contractor shall supply Systimax certified horizontal cables to connect each information outlet to the backbone subsystem on the same floor. Each workstation will consist of One pair of Voice and Data cable/jacks. Example: One (1) Voice and One (1) Data cables for each identified workstation outlet jack. Many times more than one Pair will be required at the same workstation outlet. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be as listed below. Two below options are now required based on existing cabling infrastructures and new "Universal" cabling infrastructures. The term "Universal" means that all horizontal jacks are Cat-6, mounted on racks in the MDF/IDF and can support Voice, Data, Video, etc.....

Existing Cabling Infrastructures, separate voice and data:

- **Voice Cabling:** One (1) 4-pair unshielded twisted pair (UTP), Systimax (Category-5) Blue 2010. Plenum rated
- **Data Cabling:** One (1) 4-pair unshielded twisted pair (UTP), Systimax (Category-6) Green / Gray 2071 (Gigaspeed). Plenum rated

New Cabling Infrastructures, "Universal" Voice / Data:

- **Voice/Data Cabling:** One (1) 4-pair unshielded twisted pair (UTP), Systimax (Category-6) Gray 2071 and/or 2081 (Gigaspeed). Plenum rated
- **Voice/Data Cabling:** One (1) 4-pair unshielded twisted pair (UTP), Systimax (Category-6) Gray 2071 and/or 2081 (Gigaspeed). Plenum rated

Note: WSDOT recommends that each workstation is cabled with three universal data cables to support the multiple IP connection requirements and long term support.

The 4-pair UTP cables shall be run using a star topology format from the administration subsystem (Telecommunications closet) on each floor to every individual information outlet. All cable routes to be approved by **WSDOT** prior to installation of the cabling.

The length of each individual run of horizontal cable from the administration subsystem (Telecommunications Closet) on each floor to the information outlet shall not exceed 295 ft (90 m).

Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.

Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices.

In suspended ceiling and raised floor areas where walker duct, cable trays or conduit are not available, the Contractor shall bundle station wiring with plastic cable ties at appropriate distances. The cable bundling shall be supported via "J" hooks attached to the existing building structure and framework. Plenum cable will be used in all appropriate areas.

Conduit runs installed by the contractor should not exceed 100 feet or contain more than two 90-degree bends without utilizing appropriately sized pull boxes.

Individual Work station Information Outlets

Modular furniture outlets with two or more horizontal cables shall terminate the "voice" 2010 cable in jack position 1 with a (Ivory) M1-BH modular jack. The "data" 2071 cable terminated in jack positions 2 shall be terminated with an (Black) MGS-400BH modular jack. If required, additional voice & data cables will be installed in jack position 3 & 4 respectively and/or if only one "data" 2071 cable is added it shall be terminated in jack position 3 shall be terminated with a (Black) MPS-100BH modular jack. All unused jack positions in the faceplate shall be filled with a M20AP dustcover.

Flush mount faceplates with three horizontal cables shall terminate the "voice" cable in jack position 1 with a Blue M1-BH modular jack. The "data" 2071 cable terminated in jack positions 2 shall be terminated with a Green MGS-400BH Gigaspeed modular jack. If required, additional voice & data cables will be installed in jack position 3 & 4 respectively and/or if only one "data" 2071 cable is added it shall be terminated in jack position 3 shall be terminated with a (Black) MPS-100BH modular jack. All unused jack positions in the faceplate shall be filled with a M20AP dustcover.

Note: All Information Outlets (Workstations) will be required to use the M14L Quadplex Outlet Faceplate or greater depending on the cables per conduit. M16L Sixplex and M28A Double Gang Eightplex.

Administration Subsystem

The Administration Subsystem links all of the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects.

The administration subsystem shall consist of wiring blocks for termination of copper cables or lightguide interconnection units (LIU) for the termination of optical fibers. All wall field layouts to be approved by **WSDOT** prior to installation. Separate termination fields shall be created for voice, data and building service applications.

MDF/IDF Requirements, Rack mounted Universal Ports. The Main Distribution Frame (MDF) and all Intermediate Distribution Frames (IDF's) shall be built and coded using standard Telco coding of main cables and labels (binder group labeling). Voice and Data termination blocks (fields) shall be located at least 8 feet apart unless prior approval is obtained from the Data Communication Manager.

Absence of Specifications. The absence of specifications regarding details implies that Bell Telephone Standards will prevail and that first quality material and workmanship will be supplied. Certification standards, when available, will prevail.

CABLE LABELS: Tie cable, Outlet and Voice/Data Terminal Cabling Labels. Each cable installed shall be uniquely and individually labeled at each end with matching labeling information (as specified by WSDOT). The labels used on the voice/data terminal cabling shall be of a type that are legible and permanently affixed and will stand up to future relocation(s), (i.e. mylar labels).

All backbone cables shall be labeled on both ends (within two inches) with an identifying number that remains with the specific cable from the telecommunications closets to the equipment room or entrance facility.

The IDF terminations and outlets for each voice/data terminal cable installed shall be again labeled with neat permanent markings matching the voice and data terminal cables attached. Cables that run from the telecommunications closet to the work area outlet shall have a unique identifying label within six inches of the cable end in the closet. **Matching outlet labels** (that correspond to the cable run from the IDF) **shall appear on both the outlet box as well as its faceplate.** The scheme used for outlet and voice/data terminal cable labels will be representative of the outlet location and whether the cable is for voice or data. The specific numbering scheme used should be unique and include references to the building, the floor of the building where the work area is located, the telecommunications closet serving that specific work area and the three digits identifying the work area outlet itself. The specific building code scheme will be devised under the direction of the Office of Information Technology (OIT) Network Infrastructure Manager. Any questions or exceptions to this must given prior written approval from one or both of these individuals.

Note: Many times due to the lack of space on the jack and/or the patch panel, a short abbreviated version will be allowed, with approval from WSDOT.

Example: D 1 3 B 1 0 6 T V
 (Unique Building code (Floor/Wing (Cable/Outlet #) (Cable (Application-
 Telco Closet) Type Voice, Data) UTP, Coax, Fiber)
 or
D13B106TV

FIBER CABLE LABELING. Each cable installed shall be individually labeled at each end with the matching labeling information (per example below). The labels used on the cabling shall be of a type that are legible, permanently affixed and will stand up to future changes/moves.

All backbone cables shall be labeled on both ends (within two inches) with an identifying number that remains with the specific cable from the closet, which may be used for voice or data, to the equipment room or entrance facility. All cables will be labeled at any underground open area.

The MDF and IDF terminations for each voice/data terminal cable installed shall be again labeled with neat permanent markings matching the voice/data terminal cables attached. Cables that run from the closet to the closet shall have a unique identifying label within two inches of the cable end in the closet. The specific numbering scheme should be unique and include references to the building, the floor of the building where the work area is located, the closet outlet area itself, and the fiber strand number. The specific building code scheme will be devised under the direction of Telecommunications Planning and Design Specialist (Voice) and the MIS Data Communications Manager (Data). Any questions or exceptions to this must be given prior written approval from one or both of these individuals.

Example:
D 1 Mod-1 3 C 012 F D
 (Unique Building Code) (Floor/Wing (Fiber/strand # (Cable type
 (Application- /Telco Closet) /Outlet #) Fiber) Voice,
 Data)

Cable Records. The vendor shall establish cable records during installation. These records shall, at a minimum, correlate voice terminal directory number, distribution cable number, voice terminal location and data terminal locations. Three clean, legible copies of these records shall be given to WSDOT upon project completion (1 copy to the Telecommunications Planning and Design Specialist (Voice), 1 copy to the MIS Data Communications Manager (Data) and 1 copy to be placed in the Telco Room at the installation site).

As-Built Drawings. The vendor shall provide a complete set of as-built drawings **prior** to final cable WSDOT certification testing (see Inspections below). One copy should be on Diskette in Auto-Cad readable format in addition to receiving 2 hard copy drawings. These drawings shall, at a minimum, show all distribution cable runs (RED for data; BLUE for voice), number of pairs, all distribution frames, and the location of all instruments and outlets. All outlets shall be physically labeled and these labels shall be used in the as-built drawings to indicate outlet locations. All voice and data cable paths and terminations shall be color-coded or otherwise uniquely designated in the as-built drawings. WSDOT will provide the vendor the building plans that will be used to prepare the as-built drawings.

Contractor shall supply cross-connect wire, patch cords and fiber patch cords for cross-connection and inter-connection of termination blocks and lightguide interconnection units.

The type of jumper cables shall depend on EIA/TIA Category-3, Category-5/6 applications, or fiber application and the termination block used, i.e. a punch panel, a patch panel termination block or an LIU. The administration subsystem shall consist of a rack mounted modular patch panel for all Category-6 data and voice cables, and a 600B Lightguide Shelf for optical fiber cable termination.

Data, Category-6 and/or “Universal” IDF terminations

The data cross connects shall consist of a 19” rack mounted (rack to be furnished as part of this solicitation) Category-6 GigaSpeed Patchmax modular patch panel. The data cross connects will be co-located on the rack with the LAN Hubs. If more than 48 cables are to be terminated in a single closet, a patch cord organizer must be placed between 48 port modular cross connect units. If only one modular cross connect panel is required a patch cord organizer must be placed under the panel. Horizontal Category-5 “data” cables shall be terminated directly onto this modular panel. If more than one rack is used, appropriate vertical wire management Modular patch cords shall then be run directly from the modular jack located on the front of the panel to the LAN Hub.

Modular Cords (Data Patch Panel)

AVAYA D8GS Category-6 Gigaspeed modular cords are required to connect LAN hubs to modular jacks on cross connect panel. These patch cord may be furnished as part of this solicitation depending on contract agreement. One patch cord shall be furnished for each data jack/cable.

Voice, Category-3 & 5 Cross-Connects In each IDF, the Category-3 & 5 horizontal / vertical voice cables shall be terminated on a wall mounted 110 termination block. The voice riser cable shall be terminated on an adjacent wall mounted 110-termination block, sized to terminate the associated riser cable, plus an additional 25%.

Optical fiber cross connects

The twelve fiber cable coming from the main telecommunications closet (backbone subsystem) shall be terminated in a rack mounted Systimax 600B twelve fiber termination facility, equipped with all necessary panels, clamps, covers, and couplings. The facility should be rack mounted, and have a wire management trough mounted underneath.

Fiber terminations

All Multi Mode fiber cables shall be terminated with Systimax ST connectors.

Note: Many times Single Mode or Multi Mode fiber will be used, in each case the connector type may be specified by WSDOT.

Backbone Subsystem

The main cable route within a building is called the Riser Backbone Subsystem. It links the main cross connect (MDF) in the First Floor/Concourse level to vertical / horizontal cross connects in the intermediate distribution frames (IDF) and/or telecommunications closets (TC) on each floor. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology, with first-level backbone cables beginning at the main cross connect..

All fibers will be run in innerduct and terminated in the TC's with ST type connectors in rack mounted Lightguide Distribution Shelves equipped with sufficient panels, couplers and jumper storage shelves to terminate and secure all fibers.

Adequate riser sleeve/slot space is available and/or re-enterable in all TCs such that no drilling of additional sleeves is necessary.

Contractor shall run the riser cables in a star topology, terminated in the First Floor/Concourse level at one end and in the telecommunications closet at the other end.

Contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.

Fiber backbone

The backbone subsystem shall consist of one (1) twelve fiber building cable coming from the First Floor MDF level terminating at each of the three (3) IDF's and/or TC's on each floor (total of 12 IDF / TC in building).

The fiber cable shall be AVAYA Accumax Lightguide Riser rated, multimode cable.

Copper Backbone (voice)

The voice backbone will consist of a cable run from the voice/data center level (MDF), terminating at each of the intermediate distribution closets (IDF). Riser cable shall be sized based on the following calculation: (# of work locations (jacks) x 4pair riser cable) x 1.25= # of riser pairs required. Minimum riser cable size shall be 100 pair.

The copper backbone cable shall be Systimax ARMM Riser cable.

Note: Even in a new "Universal" cabling infrastructure, voice copper backbones will be provided for facilities that have multiple IDF from the single MDF (PBX location).

Equipment Room Subsystem

The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications closet and the transmission media required to terminate this equipment on distribution hardware. **WSDOT** shall locate their equipment room on the first floor.

Fiber cross connect (data)

The twelve strand fiber cable coming from the MDF (backbone subsystem) shall be terminated in Systimax 600B 12 port termination shelves, equipped with all necessary panels, clamps and couplings. The facility should be rack mounted.

Patch Cords

Systimax ST terminated optical fiber patch cords required to connect the fiber cable terminated in the termination facility with the LAN hub may be (determined later) furnished as part of this solicitation.

Horizontal / Vertical, Category - 3 / 5, Voice cross connect.

In each IDF the voice riser cable shall be terminated on a wall mounted with 110P terminations system. Another 110P termination system shall be mounted next to the riser field for PBX cable termination. Appropriate 110AU wire managers shall be mounted between each 110-patch panel system. Cross-connects to the PBX will be run by the voice PBX vendor.

The cabling contractor shall cross-connect the Voice workstation jacks at each IDF to the vertical riser distribution cables to the common MDF equipment such as PABX or host computer in the equipment room can terminate. In other words, each voice jack from each floor will be given a jack number. This number will have a continuous continuity (cross-connected) through each IDF to the MDF, and they will be labeled the same in numerical order on the MDF (Voice cabling only).

Note: For "Universal" design, the Copper riser cable will be terminated within the IDF rack for voice patching.

At the MDF Only, all Category-3 horizontal / vertical voice cables shall be terminated on a separate wall mounted 110JP patch panel. Patch panel terminating the horizontal cables shall be sized to accommodate the appropriate number of cables and future growth.

Horizontal Category-6 Gigaspeed Data and/or "Universal" cross connect

The data cross connects shall consist of a 19" rack mounted (rack to be furnished as part of this solicitation) Category-6 Gigaspeed Patchmax modular patch panel. The data cross connects will be co-located on the rack with the LAN Hubs if room permits. If more than 48 cables are to be terminated in a single closet, a patch cord organizer must be placed between 48 port modular cross connect units. If only one modular cross connect panel is required a patch cord organizer must be placed under the panel. Horizontal Category-6 Gigaspeed "data" cables shall be terminated directly onto this modular panel. If more than one rack is used, appropriate vertical wire management Modular patch cords shall then be run directly from the modular jack located on the front of the panel to the LAN Hub.

Underground Buried Pathway (Conduits:

Building to building conduits should consist of (at a minimum) (2) each 4 inch PVC Schedule 40 conduits. All bends and sweeps (elbows) will be the largest 3-foot radius. For every 200-to 250 leninal feet a communications utility vault (5720 or equilvent) shall be provided. In the event of traffic areas, a traffic rated vault will be required. During installation a pull string shall be provided in all conduits. These WSDOT standards for conduit are based on industry standards. For example, all entrance conduit facilities for Telco Utilities are required to be a minimum of one 4-inch conduit with string.

Transition from underground conduit to above ground (EMT) building entrance conduits shall be through a watertight pull box. Use of LB's for access requires the Long LB version. Any other conduit variations and/or issues that differ from these above specifications will require approval from the IT Project Manager.

Installation

All installation shall be done in conformance with EIA/TIA 568A standards and Systimax Enhanced Category-3, 5 & 6 installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

Bonding and Grounding

The Cabling Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, racks, service boxes, and framework. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Grounding must be in accordance with the NEC, NFPA and all local codes and practices.

Power Separation

The Cabling Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

Miscellaneous Equipment

The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, wire molding (MC/MDF & TC/IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.

Special Equipment and tools

It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable wenchers.

Labeling

The Contractor shall be responsible for printed labels for all cables and cords, distribution frames, and outlet locations, according to **WSDOT** specifications at the time of delivery. No labels are to be written by hand. Cables shall be labeled to correspond with the numeric identification of each area on the architect's floor plan.

Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.

Outside plant labels shall be totally waterproof, even when submerged.

All labels shall be machine printed, with the exception of insert labels. Insert labels may be hand written, although machine printed is preferred.

Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.

To be consistent with ANSI/TIA/EIA standards and industry practices, it is important that both labeling and color-coding be applied to all telecommunications infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color-coding will quickly identify how that component is used in the overall telecommunications infrastructure of the facility.

Pathways shall be labeled at all endpoints located in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. The label shall show, as a minimum, the origin and destination of the pathway. The origin is always the point closest to the Equipment Room. All pathways entering and leaving telecommunications vaults and pull-boxes shall be labeled. Partitioned pathways, such as a duct bank or a conduit with interduct, shall have a unique identifier assigned to each partition.

Color Coding

Industry standard color-coding shall be applied to all cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color-coding may also be used to identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. The following color code shall be used in all **WSDOT** facilities:

Cabling Terminations MDF / IDF:

Orange – Reserved for identification of the telecommunication service demarcation point (demark). Orange may only be used by the telephone company.

Purple – Used to identify cables originating from common phone equipment, such as the telephone PBX / KSU. (AVAYA Definity, Panasonic, etc.)

White – Used to identify the workstation Voice / Data horizontal media termination in the building at both the MDF and/or IDF. Cross-connection and/or patch cables are used to connect to the Phone equipment or Data Hub.

Yellow – Used to identify termination of auxiliary circuits, alarms, maintenance, security, and other miscellaneous circuits.

Voice / Data Horizontal Cable Color:

Blue – Voice, Category-3 & 5

White – Data, Category-5 (Discontinued for new Gigaspeed)

Green / Gray – Data, Category-6 (Gigaspeed) (Also allow Gray to save cost 12/01)

Workstation / Outlet Jack Color:

Ivory / White – Voice Jack Outlets, Category-3 & 5

Orange – Data Jack Outlets, Category-5

Black – Data Jack Outlets, Category-6 (Gigaspeed)

As Built Documentation

Upon completion of the project, the Contractor is to prepare "As Built" documentation showing actual site conditions and installation as constructed, and provide copies of such documentation. The contractor shall provide a complete set of as-built drawings **prior** to final cable **WSDOT** certification testing (see Inspections below). One (1) copy should be on Diskette in Auto-Cad readable format in addition to receiving two (2) hard copy drawings.

These drawings shall, at a minimum, show all distribution cable runs (RED for data; BLUE for voice), number of pairs, all distribution frames, and the location of all instruments and outlets. All outlets shall be physically labeled and these labels shall be used in the as-built drawings to indicate information outlet locations. All voice and data cable paths and terminations shall be color coded or otherwise uniquely designated in the as-built drawings. If available, **WSDOT** will provide the vendor with building plans that can be used to prepare the as-built drawings.

The as-built drawings graphically document the installed telecommunications infrastructure through floor plan, elevation, and detail drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the telecommunications administration system, and must be kept current as adds, moves, and changes take place. **WSDOT** projects will require the installer to provide a complete and accurate set of as-built drawings.

MC/MDF and TC/IDF Diagrams - Includes: cable routing position of all components and apparatus detailed layout of the wall field-labeling plan. Work Area Floor Plans - Includes: detailed cable routes approved labeling plan for all work areas. Cross Connect Documentation - Includes: cross connects records for all voice, and data devices. Riser Distribution Plan Cable Tray, Conduit, and Raceway Plans Campus Distribution Plan

Testing/Warranty

Copper Cable testing

Testing of copper wiring shall be performed prior to system cutover. 100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Voice and data horizontal wiring pairs shall be tested from the information outlet to the TC. The Category-3 cable runs shall be tested for conformance to the specifications of EIA/TIA 568A Category-3. The Category-6 Gigaspeed cable runs shall be tested for conformance to the specifications of EIA/TIA 568A Category-5. Testing shall be done with a TIA/EIA TSB-67 UL Certified Level 2E test set. Test shall include mutual capacitance, characteristic impedance, attenuation and near-end and far end crosstalk. The contractor, at no charge to WSDOT, shall bring any pairs not meeting the requirements of the standard into compliance. Complete, end-to-end test results must be submitted to **(the project managers name and address/phone)**

Optical Fiber Cable Testing

All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in Section 3 of this RFP. Testing shall consist of a bi-directional end to end OTDR trace performed per EIA/TIA 455-61 or a bi-directional end to end power meter test performed per EIA/TIA 455-53A.

FIBER CIRCUIT COMPUTATION (i.e. db loss) Wavelength and Maximum Individual Fiber Loss MIFL) depend on engineering requirements and equipment to be installed. Compute FDDI cable specifications by utilizing factory attenuation of 3.4 db per km, at 850nm and 1db per km at 1300nm, and then include the 1/2db loss per cable splice and/or connector per cable run. TESTING. An OTDR test will be performed for all fiber cable runs over 328 ft. (100 meters). In all cases, all cables regardless of length will be tested using the Power Meter test at 850nm and 1350nm doing an end-to-end test according to established Systimax test procedures. All fiber strand testing will be accomplished with the results recorded on the attached cable test loss data sheet (Attachment 'A'). Three copies of the cable test results will be provided to WSDOT, one copy left at the site where the testing was performed and two copies given to the Data Communication Manager in Olympia.

In all cases not addressed in this document Systimax standards will prevail. A copy of the current Systimax Lightguide Fiber Standards will be provided upon request. First quality material and workmanship, which at a minimum meets FDDI ANSI standard X3T9.5 requirements, complying with EIA/TIA-568 standards will be used. Systimax Certification standards, for items/areas not addressed herein when available, will prevail.

Manufacturer Warranty

Contractor shall provide a twenty (20) year Systimax® SCS Extended Product Warranty and System Assurance Warranty for this cabling system.